

SUPPLY AND COST OF ALTERNATIVES TO MTBE IN GASOLINE

TECHNICAL APPENDICES

Impacts of External Markets



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IMPACTS ON EXTERNAL MARKETS

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1. INTRODUCTION

1.1 PARTIES

Acurex Environmental Corporation (Acurex) retained Purvin & Gertz, Inc., (Purvin & Gertz), on behalf of the California Energy Commission (CEC) to provide evaluations and assistance related to the proposed MTBE ban in California. Purvin & Gertz was retained to provide four deliverables: a presentation at a public workshop, a report on the supply costs of CARB gasoline and blend stocks from outside California, a report on the marine terminal infrastructure and associated limitations, a report on the external market impacts of an MTBE ban and compilation of the final report combining Purvin & Gertz work with that of other consultants. This document is the report describing the external market impact aspects of an MTBE ban.

This report has been prepared for the sole benefit of the CEC. Any third party in possession of the report may not rely upon its conclusions without the written consent of Purvin & Gertz.

Purvin & Gertz conducted this analysis and prepared this report utilizing reasonable care and skill in applying methods of analysis consistent with normal industry practice. All results are based on information available at the time of review. Changes in factors upon which the review is based could affect the results. Forecasts are inherently uncertain because of events or combinations of events that cannot reasonably be foreseen including the actions of government, individuals, third parties and competitors. ***NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.***

Others have provided some of the information on which this report is based. Purvin & Gertz has utilized such information without verification unless specifically noted otherwise. Purvin & Gertz accepts no liability for errors or inaccuracies in information provided by others.

Two other consultants, Mathpro, Inc. (Mathpro) and Energy Security Analysis, Inc. (ESAI) are preparing parallel reports on other aspects of the MTBE ban under separate contracts with Acurex. Although the goals of the work are joint, the three consultants, Purvin & Gertz, Mathpro and ESAI are working independently and none is responsible for the work or results of another. Neither Mathpro nor ESAI is responsible for any results presented in this report.

1.2 PURPOSE AND BACKGROUND

Legislative proposals have been made in California that would ban or restrict the use of MTBE as a gasoline blending component. MTBE is widely used in California as part of refiners' efforts to comply with reformulated gasoline requirements imposed by the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB). Mathpro is preparing linear program (LP) models of the California refining industry. These models are used to estimate the capabilities of the refineries to produce CARB gasoline under a variety of scenarios and the capital and operating changes that would be expected to occur in the event that MTBE is banned or restricted under a variety of scenarios. ESAI is identifying the supply costs of various oxygenate alternatives to MTBE. Purvin & Gertz has prepared supply curves for CARBOB supplies from external markets for use by Mathpro. The scope of this study is limited to the impacts on external markets of an MTBE ban. The results of all of the consultants will be combined into an aggregated report.

Policy recommendations regarding the path that should be followed with respect to the MTBE ban or restriction are to be made only by CEC. Purvin & Gertz makes no recommendation in this report whether any particular option is superior to another. Nothing in this report should be construed as making a policy recommendation. CEC is responsible for making any policy recommendations after giving appropriate consideration to the reports of all the consultants as well as to other information as may be deemed appropriate by CEC.

2. BASIC PETROLEUM PRICE SET

A set of crude oil and petroleum product prices was developed for use in the CEC analysis. These prices were used in the studies of all the consultants in order to ensure a consistent analysis. Prices for the U.S. Gulf Coast and U.S. West Coast are shown in Table 2-1.

These prices are representative of May through September 1997 market conditions and reflect actual prices witnessed during this time period. This time period was chosen for the study because it was the most recent set of prices representing the summer blending season, a time period when gasoline is in shortest supply and is most difficult to manufacture due to strict RVP restrictions.

The price relationships that are inherent in these numbers, particularly between individual products and between the West Coast and Gulf Coast markets, are simply the price relationships that were witnessed during the summer of 1997. They may or may not be representative of future price relationships or even an historical average. Price relationships of this type tend to vary, both seasonally and year on year, and depend upon the particular market conditions prevailing at the time. Any particular price relationship that is observed in this data cannot be relied upon to prevail during future time periods.

Prices were developed by reference to a variety of price reporting services and represent actual sales transactions that took place. They are based on spot transactions. Sales that occurred on a contract basis would not be represented by this data set. Crude oil posted prices also would not be represented by this data set. Furthermore, these prices represent the price of petroleum products at the refinery gate. There is no marketing or distribution cost or margin associated with them.

TABLE 2-1
CRUDE AND PRODUCT PRICING
May to August 1997

	<u>May-97</u>	<u>Jun-97</u>	<u>Jul-97</u>	<u>Aug-97</u>	<u>Average</u>
<u>Crude (Dollars per Barrel)</u>					
WTI, Cushing	20.90	19.27	19.62	19.92	19.93
Dubai, FOB	18.52	17.25	17.31	17.70	17.70
<i>West Coast Crude</i>					
Line 63, Delivered Hynes Station	18.36	16.30	16.52	16.85	17.01
Thums, Field	16.51	15.23	14.89	15.85	15.62
Kern River, FOB San Joaquin Valley Pipeline Station	14.59	13.50	13.51	14.66	14.07
ANS, Delivered West Coast	19.39	17.28	17.46	17.96	18.03
<u>Products (Cents per Gallon unless Noted)</u>					
<i>Los Angeles</i>					
Butane	26.60	29.00	28.40	30.44	28.61
Isobutane	54.82	55.00	52.80	48.75	52.82
Propane	33.90	32.63	33.30	37.00	34.22
Conv. Unleaded	60.39	53.39	55.08	73.83	60.73
CARB Unleaded	63.01	55.50	58.38	77.71	63.72
Conv. Premium	68.08	59.29	61.97	81.24	67.71
CARB Premium	67.50	59.50	62.39	82.25	67.98
Jet	59.44	56.42	55.10	58.63	57.41
Low Sulfur Diesel	55.58	53.79	51.73	57.68	54.70
CARB Diesel	61.51	58.33	56.40	67.40	60.93
HSFO 3% \$/Bbl	14.86	14.40	14.34	14.77	14.59
<i>USGC</i>					
Unleaded	60.61	54.95	58.48	64.45	59.66
RFG Unleaded	62.56	56.65	61.81	67.67	62.22
Midgrade	62.04	56.85	60.38	66.45	61.46
RFG Midgrade	64.12	58.50	63.67	69.79	64.06
Premium	64.85	60.19	64.08	70.56	64.96
RFG Premium	67.01	61.90	67.33	73.57	67.50
Jet	54.73	52.13	53.49	55.69	54.02
High Sulfur Diesel	53.40	50.13	50.95	52.23	51.69
Low Sulfur Diesel	54.14	50.69	51.80	52.94	52.41
No. 6, 3% S, \$/Bbl	14.06	13.89	14.32	15.53	14.45
MTBE	77.05	80.62	92.55	91.20	85.39
Methanol	59.40	61.38	64.30	59.80	61.22

Note: All petroleum product prices are spot refinery gate.

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3. IMPACTS ON FEDERAL RFG

3.1 ORIGINS OF IMPACTS

CARBOB or other gasoline blendstocks supplied to California markets in response to an MTBE ban in principle could have an influence on the price of gasoline in the region supplying the fuel. As fuel is drawn from a particular region to supply the shortfall in the California market, supplies in that region will diminish. Such diminished supplies may or may not have an impact on price depending on the regional supply/demand balance and the capability of the domestic refiners.

If the region normally excesses product to other regions, diminished supplies are likely to have little impact on the local price. These excess supplies would be shifted from the original destination to the California market.

If however the region is fairly well balanced, volumes that move to California will need to be replaced. Volumes can either be replaced by imports from another region or by increasing the output of the local refineries. If local refineries have enough excess capacity to make up the shortfall without too much difficulty a substantial price impact is unlikely to be seen.

If supplies are required from other regions though, the price could rise. The actual price rise will depend upon the cost to import the additional supplies. In some cases, imported supplies will cost no more than the prevailing prices, particularly if the region was already reliant on some volume of imports. In this case no substantial price increase will be seen. However, if the region becomes an importer for the first time, it is very likely that imported supplies will cost more than the prevailing price and prices in the region will rise as a result.

3.2 FEDERAL RFG MANUFACTURING

Federal reformulated gasoline (RFG) is manufactured at most large refineries east of the Rockies and in some foreign countries. Nationwide, Federal RFG accounts for more than 1.6 million barrels per day, or nearly 20% of all gasoline sold. Gulf Coast refineries produce more than 42% of the Federal RFG that is consumed in the U.S. Additional volumes are produced in PADDs I and II and are imported from Europe. Federal RFG manufacturing refineries rely heavily on alkylation and isomerization processes to meet these specifications. Since PADD III refiners produce only 18% of their gasoline as Federal RFG, however, these units are not heavily loaded just for Federal RFG. Much of the isomerate and alkylate in PADD III is used to manufacture conventional gasoline.

3.3 IMPACT OF U.S. GULF COAST REFINERIES MANUFACTURING CARBOB

No substantial price impact is expected on the U.S. Gulf Coast as a result of refineries manufacturing CARBOB for the California market. With respect to the discussion of Section 3.1, the Gulf Coast market can be classified as a region with surplus gasoline production capacity and large volumes are exported out of the Gulf Coast to other parts of the U.S.

Gulf Coast refineries manufacture approximately 3.4 million B/D of gasoline. Approximately 1.3 million B/D of this production is consumed locally while the remaining 2.1 million B/D is shipped to other parts of the U.S. PADD I, which stretches from Florida up along the East Coast to Vermont, receives about 1.6 million B/D from Gulf Coast refineries. PADD II, the mid-Western region of the U.S., receives an additional 0.5 million B/D from the Gulf Coast.

Given the large amount of gasoline that currently moves out of the Gulf Coast, it is highly unlikely that movements of CARBOB from the Gulf Coast to California will have any significant impact on prices in either the Gulf Coast market or PADDs I or II. This presumes that the volumes shipped to California are on the order of those discussed in our earlier report.

The most likely outcome of Gulf Coast refineries manufacturing CARBOB is for imports into the northeastern U.S. from Europe to increase to replace the Gulf Coast supplies that are diverted to California. The northeastern U.S. currently imports some 300,000 B/D of gasoline and additional volumes are thought to be readily available. In addition, since the region relies on imported European volumes already, higher imports are unlikely to raise the prevailing price of gasoline in the region.

PADD II will likely continue to receive supplies from the Gulf Coast at the prevailing prices.

3.4 IMPACT OF PROVIDING ALKYLATE ON FEDERAL RFG COSTS

Providing alkylate to the California market either as a blending component or as a component of CARBOB would have a negligible impact on Federal RFG production costs, providing the volume is within the range specified by our report entitled "External CARB Gasoline Supply".

Alkylate production capacity at the Gulf Coast is fairly high, averaging 545,000 B/D or about 16% of Gulf Coast gasoline production capacity. As a result, alkylate is used in all gasoline grades from Premium RFG to Conventional Regular. Although most of the alkylate used in Premium RFG is required to meet RFG specifications, a significant portion of the alkylate used in the Regular RFG and conventional grades is surplus and is not strictly required to meet specifications.

The basic premise of our earlier report that specifies the available volume of alkylate from the U.S. Gulf Coast is that only alkylate that is in excess of the volume required to meet either RFG or conventional specifications can be diverted to the California market. This volume of alkylate is fairly low valued since it can be diverted out of the Gulf Coast market without impacting the capabilities of refiners to blend their existing set of gasoline grades. Therefore removal of this alkylate in the volumes specified by our report is not expected to result in any increase in the price or value of alkylate on the Gulf Coast, nor result in any increased cost in the manufacture of reformulated gasoline.

4. PRICE ALPHAS FOR BY-PRODUCTS AND BLENDSTOCKS

4.1 DEFINITION OF PRICE ALPHAS

A price alpha is defined as the difference between the price of one commodity and that of another commodity. Price alphas often are used to estimate the prices of petroleum products for which no standard quotations exist. This would include intermediates that are manufactured within the refinery and are seldom traded. It would also include specialized products that are not manufactured or purchased by a large number of entities. Any product that is not traded often enough to warrant reporting by the price reporting services may be valued relative to more standard products using a price alpha.

Price alphas can change with changing market conditions. As with other petroleum product relationships, the price alpha can vary both seasonally or year on year. The price alphas that were estimated for the summer of 1997 for important refinery by-products and blendstocks were based on the relationships observed during that time period and may not represent future or even historical price alphas.

The price alphas that were developed for the CEC analysis were estimated consistent with the basic price set used in the CEC analysis.

4.2 RELEVANT BY-PRODUCTS AND BLENDSTOCKS

Price alphas were estimated for the following by-products and blendstocks:

- Alkylate
- Isomerate
- Pentane
- Light Coker Naphtha
- Light FCC Gasoline
- Heavy FCC Gasoline
- Heavy Reformate

Both isomerate and alkylate are high quality gasoline blendstocks that are often required to produce CARB gasoline. Pentane is a gasoline blending component that may be in excess due to its high vapor pressure. Light coker naphtha, FCC gasoline, and heavy reformate are fairly low quality gasoline blending components with various contaminants that are often difficult to blend into CARB gasoline.

4.3 PREVAILING AND EXPECTED PRICE ALPHAS

The price of alkylate was discussed in some detail in our report entitled "External CARB Gasoline Supply" and will not be further discussed here.

The remaining gasoline components were priced relative to gasoline based on their blending value in the pool. The price alpha for each was thus its estimated value during the summer 1997 time period relative to the price of CARB gasoline during that same time period.

The value of isomerate was determined in a manner similar to that of alkylate. The value of pentane was based on its value in the Gulf Coast market. The value of the rejected gasoline components was based on their value in alternative markets.